COMBUSTION HUMAN HEALTH RISK ASSESSMENT
FOR
DUPONT DOW ELASTOMERS, L.L.C.
LAPLACE, LOUISIANA

PREPARED BY

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FOREWORD

On May 18, 1993, the United States Environmental Protection Agency (EPA) announced a series of steps that the Agency would undertake, first, to achieve reductions in the amount of hazardous waste generated in this country and, second, to ensure the safety and reliability of hazardous waste combustion in incinerators, boilers, and industrial furnaces. With this announcement, EPA released its Draft Hazardous Waste Minimization and Combustion Strategy. Eighteen months later, EPA's released its Final Strategy which solidified the Agency's policy on "how best to assure the public of safe operation of hazardous waste combustion facilities." EPA's Final Strategy specifically recognized the multi-pathway risk assessment as a valuable tool for evaluating and ensuring protection of human health and the environment in the permitting of hazardous waste combustion facilities.

Region 6 believes that those combustion facilities which are in close proximity to population centers, sensitive ecosystems, sensitive receptors, or areas that may have high potential for cumulative environmental impacts, can be evaluated by a multi-pathway risk assessment to ensure that permit limits are protective of human health. Furthermore, EPA Region 6 believes that multi-pathway risk assessments should consider the specific nature of process operations and the type of combustion units and air pollution control equipment utilized at each facility in order to be representative of actual facility operations. Region 6 staff met with facility representatives and LDEQ staff prior to completing this assessment, in order to develop site-specific information. Therefore, although certain provisions of the Resource Conservation and Recovery Act (RCRA) program have since been delegated to the States, EPA Region 6 is committed to reviewing facilities on a site specific basis to evaluate the protectiveness of permits for combustion operations.

EPA Region 6, in partnership with the Louisiana Department of Environmental Quality (LDEQ), requested more comprehensive testing for boiler and industrial furnace (BIF) combustion facilities in the State of Louisiana as part of the regulatory trial burn testing conducted during early 1997 through 1998. Although the science of combustion risk assessments was still under development, BIF facilities agreed to conduct more comprehensive testing prior to EPA's completion of the revised national guidance documents for combustion emissions testing and risk assessment protocols. Based upon the nature of their operations, EPA allowed BIF facilities to demonstrate their performance at "normal operating conditions" during the trial burn by adding a separate "risk burn" test condition. The information from the risk burn was collected with the intent of EPA conducting facility-specific human health risk assessments.

In October 1998, EPA released its **Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft** (EPA530-D-98-001 A, B, and C; dated July 1998), commonly referred to as the HHRAP. In February 2000, EPA released its **Guidance on Collection of Emissions Data to support Site-Specific Risk Assessments at Hazardous Waste Combustion Facilities, Peer Review Draft** (EPA530-D-98-002; dated August 1998). EPA has also released an **Errata to the HHRAP** (EPA Memo, July 1999), which addresses issues specific to conducting human health risk assessments. EPA Region 6 has utilized the information provided in the above listed guidance documents, as well as information gained from the External Peer Review of the HHRAP and Errata, and best professional judgement to complete this human health risk assessment. This risk assessment report documents the Agency's effort in ensuring protective permit limits so that normal combustion facility operations do not pose unacceptable risks to surrounding communities.

EXECUTIVE SUMMARY

Dupont Dow Elastomers, L.L.C., Pontchartrain (DuPont) applied to the LDEQ for a RCRA permit to burn hazardous waste in a BIF unit at their facility located in LaPlace, Saint John the Baptist Parish, Louisiana. In order to assist LDEQ in identifying any additional permit conditions which might be necessary to ensure protection of human health, EPA has conducted this risk assessment. This assessment evaluates those potential emissions from one RCRA point source at the Dupont facility, a halogen acid furnace (HAF), as well as potential fugitive emissions associated with the RCRA facility operations.

EPA's risk assessment indicates that "normal operations" of the BIF hazardous waste burning unit at the DuPont facility should not adversely impact human health. In addition, EPA's risk assessment evaluates risk-based permit limits that can be incorporated into the RCRA permit in order to *supplement* regulatory maximum allowable limits and ensure protection of human health over the long term.

Waste Feed (WF) and/or Emission (EM) Rates (g/s)

Metals of Concern	**Recommended Risk-Based [1] Permit Limit *Annual* Average**	**"Normal Operations" Demonstrated [1] via the Risk Burn (3 Runs Data Average)**	
		Emissions Test	**/ Waste Feed**
Antimony	**WF 8.61E-4**	**ND [2] = 2.18E-5**	**ND [2] = 7.18E-4**
Arsenic	**WF 1.24E-3**	**ND [2] = 1.56E-6**	**ND [2] = 6.15E-5**
Barium	**WF 1.67E-2**	**7.55E-5**	**ND [2] = 9.23E-5**
Beryllium	**WF 1.24E-4**	**ND [2] = 1.04E-7**	**ND [2] = 5.13E-6**
Cadmium	**WF 1.24E-4**	**1.31E-6**	**ND [2] = 1.03E-5**
Chromium (Total)	**WF 5.64E-4**	**7.16E-5**	**5.64E-4**
Hexavalent Chromium (Cr^{+6})	**EM 4.80E-5**	**EM 1.58E-5 = 22% Total Chromium[4]**	
Lead	**WF 2.58E-2**	**ND [2] = 1.93E-5**	**ND [2] = 8.20E-4**
Mercury (Total)	**WF ND [3] @ 1.54E-5**	**ND [2] = 7.78E-7**	**ND [2] = 1.54E-5**
Silver	**WF 4.31E-4**	**ND [2] = 2.49E-6**	**ND [2] = 1.23E-4**
Thallium	**WF ND [3] @ 4.15E-3**	**ND [2] = 1.04E-4**	**ND [2] = 4.15E-3**
Nickel	**WF 7.48E-3**	**N/A**	**7.48E-3**
Selenium	**WF ND @ 1.70E-3**	**N/A**	**ND [2] = 1.70E-3**
Zinc	**WF 1.49E-3**	**N/A**	**1.49E-3**

NOTES:

1. Recommended RCRA Permit Limits are based upon an average stack gas temperature of 305 K and an average stack gas flow rate of 4.18 m^3/s; both of these parameters were demonstrated during the risk burn.

2. **WF ND** means that the metal was ***not detected*** in the waste feed samples and **EM ND** means that the metal was ***not detected*** in the emissions samples; the detection limits were used to calculate the rates shown.
3. The Recommended RCRA Permit Limit is set at the non-detect value for waste feed samples that, at most, would result in the non-detect value for emissions–a value which is lower than the calculated value evaluated in the risk assessment.
4. The value demonstrated during the Risk Burn is based upon the assumption that Hexavalent Chromium is equal to 22% of the Total Chromium measured during the risk burn. This percentage was calculated from speciated measurements taken during the Trial Burn.

EPA back-calculated risk-based annual average permit limits from the Adjusted Tier I limit for each metal of concern, with the exception of chromium. EPA back-calculated the risk-based annual average permit limit for hexavalent chromium from the Tier III limit. For total chromium and for those metals not having regulatory maximum limits specified by the regulations (i.e., nickel, selenium, and zinc), EPA calculated risk-based limits from the available risk burn data as appropriate (e.g., hexavalent form considerations for chromium). EPA then *used the calculated limits in the risk assessment* in order to show permit protectiveness over the long term.

Of special note, mercury and thallium were ***not detected*** in either emissions or waste feed samples collected during the risk burn. The initial calculated risk-based emission rates were higher than the non-detected emission rate values demonstrated during the Risk Burn, but lower than their corresponding non-detected waste feed rates–due to the different detection limits achievable for emission samples versus liquid organic waste matrices. Therefore, the mercury and thallium recommended permit limits are set at their corresponding waste feed detection limit values demonstrated during the risk burn. The waste feed detection limits demonstrated during the risk burn for each of these metals should result in emissions at the non-detect levels demonstrated during the risk burn–levels that would be less than the calculated values used in the risk assessment and shown to be protective.

EPA recommends that LDEQ incorporate all of the annual average metal feed rate limits and the emission rate limit listed above into the RCRA permit. EPA evaluated the most current information available to estimate potential impacts to human health, both directly via inhalation, incidental soil ingestion, and ingestion of drinking water (via surface water intakes), and indirectly via modeled deposition and uptake through the food chain. Emissions data collected as part of the risk burn, operational data specific to the DuPont facility, and site-specific information based upon the facility's location, were evaluated and considered in making assumptions and in predicting risks associated with long term operations. The risk estimates provided in this risk assessment are conservative in nature and represent possible future risks, based upon those operating conditions evaluated for issuance of a final RCRA combustion permit. If operations change significantly, or land use changes occur which would result in more frequent potential exposure to receptors, risks from facility operations may need to be reevaluated.

BACKGROUND INFORMATION

This risk assessment report presents a brief description of the facility and the emission sources evaluated, the air modeling effort conducted, the risk modeling effort conducted, and EPA's evaluation of risk estimates for the Dupont Dow Elastomers, L.L.C., Pontchartrain facility ("Dupont facility") located near Laplace, Saint John The Baptist Parish, Louisiana. EPA utilized the Industrial Source Complex Short Term Version 3 Program (EPA, ISCST3 software) for air modeling and the Industrial Risk Assessment Program - Health (Lakes Environmental, IRAP-h View software Version 1.7) for risk modeling. EPA utilized the ArcView

Program (Environmental Systems Research Institute, software Version 3.1), for desktop Geographical Information Systems (GIS), for all mapping efforts. All available information used to assess risks attributable to the DuPont facility can be found in electronic format, converted mainly to pdf files, in appendices enclosed via compact disc with this risk assessment report as follows:

Appendix A: Air Modeling
- Audit Files
- Input and Output Air Files from the ISCT3 Model
- Plot Files
- ISC File (file built for import into the IRAP-h Project File)

Appendix B: Spreadsheets
- Surface Roughness Calculation
- Source Emission Rate Calculations
- Transport & Fate Parameters
- Total Organic Emissions (TOE) Factor

Appendix C: Mapping
- Background Maps
- Land Use Shape Files

Appendix D: Risk Modeling
- Modified Parameters
- Source Information from the IRAP-h Project File
- Receptor Information from the IRAP-h Project File
- Risk Summary Information from the IRAP-h Project File

Appendix E: IRAP-h View Project Files
- Readme File
- DuPont.ihb - All Chemicals Run, with metals adjusted to risk-based permit limits
- DuPont Metals.ihb - Metals Only Run, Regulatory Metal Limits for DuPont facility evaluated

Since The HHRAP provides generic discussions of the uncertainties associated with each major component of the risk assessment process, this report only discusses those uncertainties particular to the site specific results evaluated for the DuPont facility. References are provided at the end of this document.

Facility and Source Information

The DuPont Pontchartrain facility is located along US Highway 61 near LaPlace, St John The Baptist Parish, Louisiana. The facility is bordered on the south by the Mississippi River, on the west by the town of Reserve, on the north by the Kansas City Southern Railroad and open agricultural land, and on the east by the town of LaPlace. Land use surrounding the facility consists primarily of a mix of rural and industrial use, including residences, commercial businesses, industrial facilities, agricultural land, surface-water bodies, and wetlands.

The DuPont facility's chemical manufacturing process generates RCRA hazardous and nonhazardous waste streams, which are burned in the facility's halogen acid furnace (HAF). The HAF is operated to produce an important co-product, hydrochloric acid (HCl), as part of the process that also destroys the waste organic chemicals that are normally produced in the manufacture of chloroprene and Neoprene(R) rubber. Liquid hazardous wastes are stored in tanks prior to introduction into the furnace and then pumped through process piping from one of the two storage tanks to one or both liquid injection burners.

The major components of the HAF were designed according to DuPont specifications and fabricated by Trane Thermal. The HAF is comprised of two parallel liquid injection combustion chambers. Each combustion chamber is a vertical cylinder with a maximum internal diameter of 5 feet 4 inches and an overall inside length of 9 feet 5.75 inches, with a cross-sectional area at the widest section being 22.3 square feet. Each combustion chamber is equipped with a Trane Thermal LV-24 vortex burner (or equivalent), which is an atomizing axial liquid waste fuel burner that has a provision for annular feed of an auxiliary fuel.

Each burner has a rated capacity of 24 million British thermal units per hour (Btu/hr), resulting in a total design capacity for the HAF of 48 million Btu/hr. Each burner is located at the top of the combustion chamber and fires downward along the axis of the vertical chamber. Liquid is atomized by either pressurized air or steam. The supply pressure of the atomization fluid to each nozzle is typically 60 to 100 pounds per square inch gauge (psig). Natural gas is the only auxiliary fuel used in the HAF, but is not fed to the furnace during normal operations. Natural gas is fed to the HAF during startup in order to obtain the minimum combustion chamber temperature and also during automatic waste feed cutoffs to keep the combustion chamber hot.

Combustion products from the HAF are controlled by an air pollution control (APC) system that consists of a four-stage absorption train and a Dynawave™ scrubber. Combustion products from each combustion chamber enter two parallel gas cooling spray chambers prior to being routed to one of two primary water absorbers for additional cooling. Product gases from the two parallel gas cooling systems enter a single common water absorption train consisting of a secondary absorber, a tertiary absorber, and a vent scrubber. Product acid from the primary and secondary absorption columns flows to HCl product storage tanks located onsite (product acid strength generally ranges from approximately 10 to 28 wt% HCl). HCl remaining in the cooled product gas after the primary absorbers is absorbed in the re-circulation liquid flowing countercurrently down the three packed absorption columns.

Gases exiting the vent scrubber enter the top of the Dynawave scrubber where they collide with an aqueous scrubbing liquid containing a reducing agent. The Dynawave scrubber effectively removes both chlorine and residual hydrogen chloride from the vent scrubber effluent. Dynawave scrubber water effluent is either disposed in an onsite hazardous waste deep injection well or reused as feedwater to the HAF scrubbing train. Gases leaving the Dynawave scrubber are discharged to the atmosphere through a 120-foot stack by an induced draft fan located at the inlet of the scrubber. The induced draft fan consists of a Robinson Industries Model No. RB-1210-4 or an equivalent centrifugal blower with a rating of 375 cubic meters per minute at 38 °C.

The HAF is equipped with many automatic controls and automatic shutdown systems including high waste feed rate, high carbon monoxide in the exhaust gases, high combustion airflow rate, low scrubber blowdown, and low Dynawave scrubber pH. In addition, the unit also has dual continuous emissions monitoring systems for both carbon monoxide and oxygen. The entire HAF system from combustion chambers through the vent scrubber are operated under negative pressure to prevent fugitive emissions. Fugitive emissions from valves, flanges, and pumps are controlled through a Leak Detection and Repair Program and by using dual mechanical seal pump systems.

Dupont operates the HAF unit under an Adjusted Tier I status for all metals except chromium, which simply means that all of these metals fed to the unit are assumed to be emitted in the stack gas. Therefore, the regulations limit all stack metal emissions except chromium based upon the hourly feed rate of individual metals into the combustion unit. For chromium, DuPont operates the HAF under a Tier III status, which

means that the permit limit for chromium is based on the average of stack emissions data collected during the trial burn rather than waste feed rates. The trial burn testing demonstrated greater than 99.999 % efficiency for destruction and removal of organic materials, and system removal efficiency ranging from 90% to 99% for trace metals associated with emissions (Metco Environment, 1997). In addition, the trial burn testing demonstrated that of the Total Chromium emitted, only 22% is in the hexavalent form.

LDEQ and EPA provided oversight at the risk burn testing as well as the trial burn testing for Dupont. A risk burn is considered an additional operating condition of the trial burn during which data are collected to demonstrate that the hazardous waste-burning HAF unit does not pose an unacceptable health risk when operating at typical (or normal) operating conditions over the long term. In order to simulate worst case wastes, the RCRA hazardous waste streams fed into the HAF during the risk burn at the DuPont facility included: 1) HCl waste; 2) chloroprene heel waste transported from the Dupont Dow Louisville facility; 3) catalyst sludge receiver waste; and 4) other waste organics. Target operating conditions for the risk burn included the following: (1) liquid waste feed rate of 5,000 pounds per hour (lb/hr); (2) chlorine feed rate of 2,500 lbs/hr; and (3) combustion chamber temperature at 1,500^{o}C. Measurements taken during the risk burn demonstrated a stack gas flow rate of 4.2 m^3/sec, a stack gas exit velocity of 25.17 m/sec, and an exit temperature of 305.22 K (32 °C or 90 °F) for normal operating conditions (i.e., these measurements are averages for runs reported in the DuPont Risk Burn Report, April 1997, Volume 1). The HAF stack is 36.58 meters (120 feet) above grade and has an inside diameter of 0.46 meters (1.5 feet) at its exit. The DuPont facility voluntarily conducted stack testing for all metals, as well as the required waste feed sampling, during the risk burn.

Air Modeling

EPA used the ISCST3 for determining air dispersion and deposition of compounds resulting from operations at the DuPont facility in accordance with the HHRAP. EPA evaluated emission sources using primarily the data and information provided in the DuPont Risk Burn Report dated April 1997 and revisions dated September 1997 and supplemental information requested by EPA and provided by DuPont in the "Fugitive Emission Estimating Data Report" dated February 4 and 24, 1999.

EPA modeled two separate emission sources for the Dupont facility: one stack source, the HAF and one volume area source (designated as F1) to account for fugitive emissions associated with ancillary equipment to the HAF including the two halogen acid furnace feed storage tanks. EPA evaluated emissions from the HAF as if operations occur for 365 days per year.

Universal Transverse Mercator (UTM) projection coordinates in North American Datum revised in 1983 (NAD83) for each source are as follows: for the HAF, (738542.65, 3327710.77); and for F1 (738580.46, 3327675.40). EPA used a stack gas flow rate of 4.2 m^3/sec, a stack gas exit velocity of 25.17 m/sec, and a stack gas exit temperature of 305. 22 K (90 °F) as input to ISCST3. EPA used a height of 5 meters (assumed midpoint of height of equipment) and an area of approximately 124 square meters (m^2) for evaluation of F1.

Modeling for the Dupont facility was based upon an array of receptor grid nodes at 100-meter spacing out to a distance of 3 kilometers from the facility and an array of receptor grid nodes at 500-meter spacing between a distance of 3 kilometers and out to a distance of 10 kilometers from the facility. Unitized concentration and deposition rates were determined by the ISCST3 model for each receptor grid node for use in assessing risks. Consistent with the HHRAP, water body and watershed air parameter values were obtained from the single

receptor grid node array without need for executing values to a separate array.

Terrain elevations based on 90-meter spaced USGS digital elevation data were specified for all receptor grid nodes. Other site-specific information used to complete the ISCST3 model included the most current surrounding terrain information, surrounding land use information, facility building characteristics, and meteorological data available. Meteorological data collected over a 5-year period from representative National Weather Service (NWS) stations near the facility were used as inputs to the ISCST3 model. The surface data was collected from the New Orleans NWS station. The upper air data was collected from the Boothville (1984, 1985, 1986, and 1987) and Slidell (1989), Texas NWS stations.

Model runs were executed for accurate evaluation of partitioning of all compounds specific to vapor phase, particle phase, and particle-bound phase runs. In addition, particle diameter size distributions and mass fractions for each source stack were based on the values determined during the risk burn. **Appendix A** contains all air modeling information utilized and generated for the DuPont facility.

Compounds of Potential Concern (COPCs)

EPA identified Compounds of Potential Concern (COPCs) in accordance with the HHRAP. EPA dropped phthalate compounds from the risk analysis since the DuPont facility does not burn plastics or materials with phthalate plasticizers and since phthalate compounds were not detected in any of the risk burn runs. In addition, EPA eliminated some compounds from the quantitative risk analysis based upon availability of toxicity data and/or transport and fate data. Of those chemicals dropped from the risk analysis, none were actually detected in emissions samples. **Appendix B** contains EPA-calculated COPC-specific emission rates used in the risk assessment for each source, including the fugitives area, and provides justification for all chemicals dropped from the risk analysis. EPA input these COPC-specific emission rates directly into the risk model, which allowed calculation of compound-specific media concentrations in order to estimate risks.

EPA evaluated both waste feed and stack emissions data for organic and inorganic compounds collected during the risk burn conducted between April 23 and 24, 1997, in order to calculate emission rates. EPA reviewed a letter from the facility dated September 10, 1999, in order to determine a site-specific upset factor of 1.001 for use in calculation of COPC-specific emission rates for organic compounds. EPA used an upset factor of 1.0 for inorganic compounds evaluated at the Adjusted Tier I and Tier III limits since these limits are maximum regulatory limits based upon waste feed and emissions data collected as part of the facility's Certification of Compliance (COC). EPA then reviewed the COC form on file, dated 1997, for the DuPont facility in order to compare the Adjusted Tier I levels with operations data collected during the risk burn. Finally, in order to properly assess fugitive emissions associated with DuPont's typical operations, EPA evaluated supplemental information provided by DuPont in the "Fugitive Emission Estimating Data Report" dated February 4 and 24, 1999. This document provided historical information on the typical mix of specific compounds in the waste feed and the engineering details for equipment in the areas being evaluated.

Of special note, EPA initially evaluated DuPont's maximum allowable regulatory limits for the HAF unit (i.e., most metals being Adjusted Tier 1 Feed Rate Limits, hexavalent chromium being a Tier III Emission Rate Limit) and found that the maximum limits for several metals would need to be supplemented with lower annual average limits (risk-based limits) in order for the *permit* to be protective of human health. Since the risk burn data as well as the COC form for the DuPont facility show that typical operations result in emission rates which are orders of magnitude below the maximum allowable regulatory limits, EPA back-calculated risk-based annual average permit limits from the Tier limit for each metal of concern. For total chromium

and for those metals not having regulatory maximum limits specified by the regulations (i.e., nickel, selenium, and zinc), EPA calculated risk-based limits from the available risk burn data as appropriate (e.g., hexavalent form considerations for chromium). EPA then *used the calculated limits in the risk assessment* in order to show permit protectiveness over the long term.

Waste Feed (WF) and/or Emission (EM) Rates (g/s)

Metals of Concern	Regulatory Tier-Based [1] Permit Limit Max Allowable	Recommended Risk-Based [2] Permit Limit Annual Average	"Normal Operations" Demonstrated [2] via the Risk Burn (3 Runs Data Average) Emissions Test / Waste Feed
Antimony	**WF 8.61E-1**	**WF 8.61E-4**	**ND [3] = 2.18E-5** / **ND[3] = 7.18E-4**
Arsenic	**WF 1.24E-3**	**WF 1.24E-3**	**ND [3] = 1.56E-6** / **ND[3] = 6.15E-5**
Barium	**WF 1.67E+0**	**WF 1.67E-2**	**7.55E-5** / **ND [3] = 9.23E-5**
Beryllium	**WF 1.24E-3**	**WF 1.24E-4**	**ND [3] = 1.04E-7** / **ND [3] = 5.13E-6**
Cadmium	**WF 1.24E-3**	**WF 1.24E-4**	**1.31E-6** / **ND [3] = 1.03E-5**
Chromium (Total)	**N/A**	**WF 5.64E-4**	**7.16E-5** / **5.64E-4**
Hexavalent Chromium (Cr^{6+})	**EM 2.35E-3**	**EM 4.80E-5**	**EM 1.58E-5 = 22% Total Chromium[5]**
Lead	**WF 2.58E-1**	**WF 2.58E-2**	**ND [3] = 1.93E-5** / **ND [3] = 8.20E-4**
Mercury (Total)	**WF 8.61E-1**	**WF [4] ND @ 1.54E-5**	**ND [3] = 7.78E-7** / **ND [3] = 1.54E-5**
Silver	**WF 4.31E-1**	**WF 4.31E-4**	**ND [3] = 2.49E-6** / **ND [3] = 1.23E-4**
Thallium	**WF 8.61E-1**	**WF [4] ND @ 4.15E-3**	**ND [3] = 1.04E-4** / **ND [3] = 4.15E-3**
Nickel	**N/A**	**WF 7.48E-3**	**N/A** / **7.48E-3**
Selenium	**N/A**	**WF ND @ 1.70E-3**	**N/A** / **ND [3] = 1.70E-3**
Zinc	**N/A**	**WF 1.49E-3**	**N/A** / **1.49E-3**

NOTES:

1. Regulatory Permit Limits are based upon the Tier Level requested by the facility. DuPont currently operates under Adjusted Tier 1 status for all metals except Chromium, which is specified under Tier III in the Hexavalent form.
2. Recommended RCRA Permit Limits are based upon an average stack gas temperature of 305 K and an average stack gas flow rate of 4.18 m^3/s; both of these parameters were demonstrated during the risk burn.
3. **WF ND** means that the metal was ***not detected*** in the waste feed samples and **EM ND** means that the metal was ***not detected*** in the emissions samples; the detection limits were used to calculate the rates shown.
4. The Recommended RCRA Permit Limit is set at the non-detect value for waste feed samples that, at most, would result in the non-detect value for emissions–a value which is lower than the calculated value evaluated in the risk assessment.
5. The value demonstrated during the Risk Burn is based upon the assumption that Hexavalent Chromium is equal to 22% of the Total Chromium measured during the risk burn. This percentage was calculated from speciated measurements taken during the Trial Burn.

As the above comparison shows, DuPont demonstrated during the risk burn that feed rate limits during "normal operations" fall at (non-detects) or below the recommended permit limits.

EXPOSURE ASSESSMENT

Exact locations where people can potentially be exposed to contaminants in the air, surface water, or soil are determined by the grid spacing used in the air model and subsequently imported into the risk model. These specific locations can be used for assessing exposure for a particular type of receptor based upon the land use type being evaluated (i.e., farming or residential). Since plants or animals can also be exposed to contaminants at these coordinates points, possible uptake through the food chain can be assessed based upon the type of land use designated.

The potential exposure scenarios evaluated in this risk assessment include both adult and child receptors for the following land use types: residential, subsistence farming, and subsistence fishing. In all cases, EPA used default values for receptor specific parameters, as outlined in the HHRAP. However, for dioxins and furans, EPA used updated bioaccumulation factors and toxicity equivalency values based upon the results of the External Peer Review of the HHRAP Guidance (External Peer Review Meeting, May 2000). Please see the Uncertainty Section of this risk assessment for a discussion of those parameters modified for specific dioxin/furan cogeners. Current land use was considered in determining those receptors potentially impacted by identified emission sources, while potential future land use was assumed to be the same as current land use.

Study Area Characterization

Although the study area for air modeling purposes extends out approximately 10 kilometers from the HAF, the risk assessment evaluated possible exposure based upon potential receptors located closer to the facility where the ***reasonable maximum risks*** to various types of receptors might occur. Specifically, discrete land use areas where results of the air modeling indicated maximum air concentration or maximum deposition of COPCs might occur typically fell within a 3 kilometer radius from the HAF. EPA then evaluated multiple locations within each discrete land use area potentially impacted, in accordance with the HHRAP. This ensured that all possible receptors were evaluated for identifying reasonable maximum risks for each exposure scenario type.

Potentially impacted water bodies and their associated effective watershed areas were also evaluated as part of the risk assessment. EPA evaluated the following water bodies: Mississippi River, LaPlace Ponds (North and South), and Bonnet Carre Point. Although some of the ponds may not currently be used for fishing, EPA evaluated each pond for fishing consumption based upon the potential for fishing to occur. Additionally, LaPlace currently obtains its drinking water from the Mississippi River adjacent to the Lyons subdivision within the 3 kilometer radius of the facility so this portion of the river was evaluated for drinking water use. These assumptions may have been overly conservative for evaluation of current use, but did not require further evaluation since resulting risks for the drinking water and fish consumption pathways were well below EPA levels of concern.

EPA contractors conducted a site visit to verify information shown on digitized land use land cover maps, topographic maps, and aerial photographs. EPA utilized the internet to locate and verify local schools and daycare facilities on the topographic maps. EPA also requested and obtained input from LDEQ and facility

representatives on actual land use designations used. **Appendix C** contains the topographic, land use, and watershed maps which show the specific areas evaluated as part of the study area–as well as those effective watershed areas specific to this risk assessment.

Exposure Scenario Locations

The exposure scenario locations in this risk assessment were chosen to be representative of potential maximally exposed individuals, or receptors, within each representative land use type. EPA also evaluated receptors where actual land use dictated consideration of *special sub-populations*, as defined in the HHRAP. However, all of these locations were already being accounted for by placement of nearby residential receptors (i.e., inclusive of children). Infant potential exposure to dioxins and furans via the ingestion of their mother's breast milk is evaluated at corresponding adult scenario locations (i.e., locations where the mother may live). Receptor locations for a child's potential exposure to lead in soil and air are the same as the various child scenario locations. Fisher receptors were placed at residential scenario locations near each water body evaluated. All exposure scenario locations are shown on those topographic maps provided in **Appendix C**, and are also provided via a coordinate list exported from the risk model project file in **Appendix D**.

Transport and Fate Parameters

EPA used transport and fate equations presented in the HHRAP to determine air, soil, and surface water COPC-specific concentrations. Those equations which determine uptake of specific COPCs in the food chain (i.e., COPC concentrations in fish, pork, milk, eggs, etc.) allow the use of parameters derived as either default values, also provided in the HHRAP, or facility/site-specific values, as available and appropriate. Site-specific transport and fate parameters utilized for the DuPont facility include universal soil loss constants, delineation of water body and effective watershed areas potentially impacted by facility sources, water body depth, and average annual total suspended solids concentration.

Of special note is EPA's decision to use 40 years for the time of COPCs deposition (i.e., facility operational time), rather than the 100 years recommended by the HHRAP. EPA Region 6 considerations in using 40 years as opposed to 100 years include the following: 1) the longest receptor exposure duration is 40 years; and 2) RCRA permit renewals are required every 10 years so risks can be reevaluated at any time utilizing the most current transport and fate information available at that time.

Site-specific transport and fate parameters are provided in the spreadsheet provided in **Appendix B**. COPC-specific chemical and physical parameters are not provided in this risk assessment report since they can be found in Appendix A of the HHRAP and also in EPA's July 1999 Errata to the HHRAP. The IRAP-h View Version 1.7 utilizes all updated information found in EPA's Errata to the HHRAP.

RISK CHARACTERIZATION

In this risk assessment, EPA evaluated chronic excess risk estimates for both ***direct exposure pathways***, or those pathways where contact may occur with a contaminated media (i.e, inhalation, incidental soil ingestion, and ingestion of drinking water), and also ***indirect pathways*** (i.e., those risks associated with uptake through the food chain). EPA also evaluated the potential for non-carcinogenic health effects to occur by calculation of hazard indices (HIs) for the various COPCs identified at the DuPont facility. In addition, EPA assessed the following: 1) potential acute effects (i.e., risks associated with short-term emissions) from inhalation; 2) potential impacts from possible accumulation of dioxin and furan compounds in breastmilk; and 3) potential

adverse impacts for small children (i.e., children under 6 years old) who are susceptible to lead exposure in surface soils and ambient air.

For those chemicals detected in stack gas emissions or quantified as fugitive source emissions at the DuPont facility, EPA found that RCRA operations should not pose adverse impacts for any of the receptors evaluated. For those chemicals not actually detected in stack gas emissions or not detected in the waste feed analysis, please see the Uncertainty Section of this report. EPA used target action levels identified in the **Region 6 Risk Management Addendum - *Draft Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*** (EPA-R6-98-002, July 1998) to evaluate resulting risk estimates.

Excess Cancer Risks

For those COPCs detected in stack gas emissions or quantified as fugitive source emissions at the DuPont facility, chronic excess cancer risk estimates attributed to both ***direct exposure pathways*** and ***indirect exposure pathways*** are all well below EPA's 1×10^{-5} level of concern for all receptors evaluated. This means that there is less than one chance in one hundred thousand of a person getting cancer from possible exposure to RCRA combustion emissions associated with the DuPont facility.

Excess cancer risk estimates for each receptor, delineated by source and specific COPC, are provided via a summary table exported from the risk model project file, "copc_risk" in **Appendix D**. In addition, excess cancer risk estimates for each receptor, delineated by pathway, are provided in a summary table exported from the risk model project file, "pathway" in **Appendix D**. The next to last column of each table contains the excess cancer risk estimates.

Non-Carcinogenic Health Effects

For those COPCs detected in stack gas emissions or quantified as fugitive source emissions, the HIs associated with both direct and indirect pathways are all well below EPA's 0.25 level of concern for all receptors evaluated. This means that a person's health should not be adversely effected by possible exposure to RCRA combustion emissions at the DuPont facility.

The HI estimates for each receptor, delineated by source and specific COPC, are provided via a summary table exported from the risk model project file, "copc_risk" in **Appendix D**. In addition, HI estimates for each receptor, delineated by pathway, are provided in a summary table exported from the risk model project file, "pathway" in **Appendix D**. The last column of each table contains the HI estimates.

Other Risks

Acute Hazard Quotients are all less than 1.0 for those receptors evaluated. This means that a person's health should not be adversely effected from direct inhalation of the maximum 1-hour concentration of vapors and/or particulates associated with RCRA combustion emissions at the DuPont facility. An acute adverse health effect is defined here as a concentration intended to protect the general public from discomfort or mild adverse health effects over 1 hour of possible exposure. See the summary table exported from the risk model project file, "acute" in **Appendix D**.

For dioxin-like compounds, calculations show that projected possible intakes for babies who are breastfed are all well below the average infant intake target level of 60 pg/kg-day of 2,3,7,8-TCDD Equivalents. See the summary table exported from the risk model project file, "b-milk" in **Appendix D**. More detailed information relating to dioxins and potential exposure and risk characterization for dioxins can be found at

the EPA website http://www.epa.gov/nceawww1/dioxin.htm (contains documents generated as part of the Dioxin Reassessment Initiative).

For lead, calculations show that projected possible concentrations in surface soils and ambient air should not exceed EPA target levels of 100 mg/kg and 0.2 ：g/m^3, respectively. This means that concentrations of lead predicted to occur in soils and ambient air from RCRA combustion emissions at the DuPont facility are at levels which should not adversely impact the health of children under the age of 6 years old (i.e., those children who are susceptible to health impacts from lead exposure). See the summary table exported from the risk model project file, "lead" in **Appendix D**.

UNCERTAINTY DISCUSSION

Uncertainty is inherent in any risk assessment process, and in the case of combustion risk assessments, can become complex in consideration of the necessary integration of various data, process parameters, and modeling efforts undertaken. Uncertainties and limitations of the risk assessment process are discussed in general in Chapter 8 of the HHRAP and in more detail in each separate chapter of the HHRAP. Therefore, this risk assessment will not reiterate that lengthy discussion, but will complement it by addressing specific key areas of interest which were identified during EPA's evaluation of resulting risk estimates at the DuPont facility. Some, if not all, of these areas of interest have been identified by other EPA regions and/or State partners conducting risk assessments at similar combustion facilities across the country.

Modified Parameters for Dioxins/Furans

Please see the "Modified Parameters" file in **Appendix D** for an all-inclusive parameter list of chemical-specific values used in this human health risk assessment (i.e., a side-by-side comparison of the modified value versus the original default value for each COPC-specific parameter). For the DuPont facility, the only compounds where chemical-specific values were modified include individual dioxin/furan cogeners. Modifications are based upon input from the External Peer Review of EPA's HHRAP and Errata (External Peer Review Meeting, May 2000).

In determining the bioaccumulation factors for chickens ($Ba_{chicken}$) and eggs (Ba_{egg}), as published in the July 1999 Errata to the HHRAP, EPA assumed that the bioconcentration factors (BCFs) presented in the 1995 Stephens, Petreas, and Hayward paper were calculated as the ratio of the dioxin/furan concentration in tissue to the concentration in soil. However, the BCFs were actually calculated as the ratio of dioxin/furan concentration in tissue to the concentration in feed. Therefore, since the soil/feed mixture fed to the chickens was one part soil and nine parts feed (1:9), the bioaccumulation factors presented in the Errata would appear to be ten-fold too high. Therefore, EPA reduced the $Ba_{chicken}$ and BA_{egg} values provided in the Errata by a factor of 10 for those cogeners evaluated ("Biotransfer and Bioaccumulation of Dioxins and Furans from Soil: Chickens as a Model for Foraging Animals"; Stephens, Petreas, and Hayward, 1995).

Additionally, since publication of the July 1999 Errata to the HHRAP, EPA's Office of Solid Waste has recommended use of the 1997 World Health Organization (WHO, 1997) Toxicity Equivalency Factors (TEFs) for dioxin/furan cogeners. Therefore, EPA Region 6 changed appropriately those three cogeners where TEFs specified in the HHRAP were different than the WHO values recommended for human health

risk assessments (i.e., 1997 WHO TEFs for fish, mammals, and birds).

Bio-Transfer Factors

In completing the evaluation of risk estimates for the DuPont facility, EPA has noted that biotransfer factors are primarily responsible for artificially high risk estimates for certain compounds. Specifically, two polycyclic aromatic compounds (PAHs) were identified for further evaluation when resulting risk estimates seemed disproportionate for the low level emission rates (i.e., rates based upon non-detected levels) used in the DuPont risk assessment:

indeno(1,2,3-cd)pyrene and dibenz(a,h)anthracene

The farmer scenario uses beef and milk biotransfer factors based upon the *n*-octanol/water partition coefficient (K_{ow}), as specified in the HHRAP. However, the HHRAP also provides discussion about the possibility of decreasing (rather than increasing) biotransfer values with increasing K_{ow} values. The two PAH compounds in question fall within the range cited (log K_{ow} between 6.5 and 8.0). The HHRAP suggests that this trend may be due to a greater rate of metabolism of higher K_{ow} compounds (HHRAP, Volume 2, Appendix A pages A-3-25 thru A-3-26). In addition, other literature sources (Gorelova and Cherepanova, 1970; Gorelova et al., 1970) acknowledge that PAHs with large K_{ow} values are readily metabolized by the mixed function oxidase metabolic pathway in mammals to water-soluble substances, which are then excreted. Therefore, the resulting risk estimates for these two PAHs may be biased high. In other words, EPA believes that the potential risk from exposure to these two compounds is not of concern since these two PAHs tend not to bioaccumulate in animal or human tissue, but rather to be metabolized and excreted.

Use of Non-Detected Compounds

Compounds which were quantified as not present at or above a laboratory specified reporting limit but could possibly be formed as products of incomplete combustion, were used in calculation of risk estimates. For example, PAHs are semi-volatile compounds typically associated with combustion sources. Therefore, EPA retained and considered these compounds in the risk assessment in accordance with the HHRAP even though they were not detected in any of the analyses conducted.

Additionally, EPA followed the HHRAP in determining the appropriate detection limits to use in estimating emission rates for non-detected compounds. However, since the HHRAP does not address the appropriate detection limit for waste feed samples, EPA used Sample Quantitation Limits (SQLs) to calculate emission rates for non-detected compounds, as reported by the laboratory. Conceptually, SQLs are the most appropriate detection limit to use for waste matrices where compounds are suspected to be present but interferences may occur to obscure the detection of certain compounds as presented in EPA's **Guidance for Data Useability in Risk Assessment** (Publication 9285.7-090A; April 1992).

Although using non-detected compounds may tend to overestimate risks to some degree, all compounds which were retained in the DuPont risk assessment resulted in risk estimates well below EPA levels of concern with the exception of two PAH compounds. The same two PAH compounds discussed in the prior section were not detected in stack emissions, but were assumed to be present at their Reliable Detection

Level (RDL). In other words, in addition to risk estimates for these two compounds being biased high due to use of biotransfer factors which do not account for metabolization, the risk estimates may also be biased high due to use of emission rates based upon non-detected values. Therefore, EPA believes that these two PAH compounds do not actually pose adverse health impacts–even assuming the compounds are present at their RDLs.

Compounds Dropped from Quantitative Analysis

Of those compounds dropped from the risk analysis due to a lack of toxicity or transport and fate information, none of the chemicals dropped were actually detected in the emissions data. Since these compounds do not have toxicity data and/or transport and fate information, and since they were not detected in emissions, they can not be quantitatively or even qualitatively evaluated in the risk assessment.

Unidentified Organic Compounds

DuPont conducted Total Organic Emissions (TOE) testing in accordance with the HHRAP. Permitting authorities need this information to address concerns about the unknown fraction of organic emissions from combustion units. Using the TOE test results, and the speciated data from the Risk Burn, EPA calculated a TOE factor which falls at the low end of the range anticipated in the HHRAP (2 - 40). Based upon these results, and the process information available for the DuPont facility, EPA believes that unidentified organic compounds do not contribute significantly to those risk estimates calculated in this risk assessment.

CONCLUSION & RECOMMENDATIONS

EPA's risk assessment indicates that "normal operations" of the BIF units at the DuPont facility should not adversely impact human health. Additionally, EPA's risk assessment shows that the appropriate regulatory maximum permit limits (Adjusted Tier 1 Feed Rate Limits and Tier II Emission Rate Limit for Hexavalent Chromium) for the DuPont hazardous waste combustion unit should be supplemented with lower annual average limits (risk-based limits) for several metals in order for *the permit* to be protective of human health. Therefore, EPA recommends that LDEQ incorporate the annual average permit limits listed below into the RCRA permit.

Waste Feed (WF) and/or Emission (EM) Rates (g/s)

Metals of Concern	Regulatory Tier-Based [1] Permit Limit Max Allowable	Recommended Risk-Based [2] Permit Limit Annual Average	"Normal Operations" Demonstrated [2] via the Risk Burn (3 Runs Data Average) Emissions Test / Waste Feed
Antimony	WF 8.61E-1	WF 8.61E-4	ND [3] = 2.18E-5 / ND[3] = 7.18E-4
Arsenic	WF 1.24E-3	WF 1.24E-3	ND [3] = 1.56E-6 / ND[3] = 6.15E-5
Barium	WF 1.67E+0	WF 1.67E-2	7.55E-5 / ND [3] = 9.23E-5
Beryllium	WF 1.24E-3	WF 1.24E-4	ND [3] = 1.04E-7 / ND [3] = 5.13E-6
Cadmium	WF 1.24E-3	WF 1.24E-4	1.31E-6 / ND [3] = 1.03E-5
Chromium (Total)	N/A	WF 5.64E-4	7.16E-5 / 5.64E-4
Hexavalent Chromium (Cr^{6+})	EM 2.35E-3	EM 4.80E-5	EM 1.58E-5 = 22% Total Chromium[5]
Lead	WF 2.58E-1	WF 2.58E-2	ND [3] = 1.93E-5 / ND [3] = 8.20E-4
Mercury (Total)	WF 8.61E-1	WF [4] ND @ 1.54E-5	ND [3] = 7.78E-7 / ND [3] = 1.54E-5
Silver	WF 4.31E-1	WF 4.31E-4	ND [3] = 2.49E-6 / ND [3] = 1.23E-4
Thallium	WF 8.61E-1	WF [4] ND @ 4.15E-3	ND [3] = 1.04E-4 / ND [3] = 4.15E-3
Nickel	N/A	WF 7.48E-3	N/A / 7.48E-3
Selenium	N/A	WF ND @ 1.70E-3	N/A / ND [3] = 1.70E-3
Zinc	N/A	WF 1.49E-3	N/A / 1.49E-3

NOTES:

1. Regulatory Permit Limits are based upon the Tier Level requested by the facility. DuPont currently operates under Adjusted Tier 1 status for all metals except Chromium, which is specified under Tier III in the Hexavalent form.
2. Recommended RCRA Permit Limits are based upon an average stack gas temperature of 305 K and an average stack gas flow rate of 4.18 m^3/s; both of these parameters were demonstrated during the risk burn.
3. **WF ND** means that the metal was ***not detected*** in the waste feed samples and **EM ND** means that the metal

was ***not detected*** in the emissions samples; the detection limits were used to calculate the rates shown.
4. The Recommended RCRA Permit Limit is set at the non-detect value for waste feed samples that, at most, would result in the non-detect value for emissions–a value which is lower than the calculated value evaluated in the risk assessment.
5. The value demonstrated during the Risk Burn is based upon the assumption that Hexavalent Chromium is equal to 22% of the Total Chromium measured during the risk burn. This percentage was calculated from speciated measurements taken during the Trial Burn.

As the above comparison shows, DuPont demonstrated during the risk burn that feed rate limits during "normal operations" fall at (non-detects) or below the recommended permit limits.

EPA evaluated the most current information available to estimate potential impacts to human health, both directly via inhalation, incidental soil ingestion, and ingestion of drinking water (via surface water intakes), and indirectly via modeled deposition and uptake through the food chain. Emissions data collected as part of the risk burn, operational data specific to the DuPont facility, and site-specific information based upon the facility's location, were evaluated and considered in making assumptions and in predicting risks associated with long term operations. The risk estimates provided in this risk assessment are conservative in nature and represent possible future risks, based upon those operating conditions evaluated for issuance of a final RCRA combustion permit. If operations change significantly, or land use changes occur which would result in more frequent potential exposure to receptors, risks from facility operations may need to be reevaluated.

REFERENCES

1. **Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft** (EPA530-D-98-001 A, B, and C; July 1998); **Errata to the HHRAP** (EPA, July 1999).

2. **Guidance on Collection of Emissions Data to Support Site-Specific Risk Assessments at Hazardous Waste Combustion Facilities, Peer Review Draft** (EPA530-D-98-002; August 1998).

3. **Risk Burn Report for DuPont Dow Elastomers** (April 1997; cover letter with revisions dated September 25, 1997).

4. **"Fugitive Emission Estimating Data Report"** for DuPont Dow Elastomers (February 4, 1999; February 24, 1999).

5. Letter from DuPont Dow pertaining to upset conditions (September 10, 1999).

6. **Certificate Of Compliance** for the DuPont facility (1997).

7. ***External Peer Review Meeting, HHRAP and Errata***. (TechLaw, Inc.; Dallas, Texas; May 2000).

8. **Region 6 Risk Management Addendum** - ***Draft Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*** (EPA-R6-98-002, July 1998).

9. **Biotransfer and Bioaccumulation of Dioxins and Furans from Soil: Chickens as a Model for Foraging Animals** (Stephens, Petreas, and Hayward, 1995).

10. **World Health Organization (WHO)** *Meeting on the Derivation of Toxicity Equivalency Factors (TEFs) for PCBs, PCDDs, PCDFs, and other Dioxin-like Compounds for Human Health & Wildlife, June 15 - 18, 1997*. Institute of Environmental Medicene, Karolinska Institute, Stockholm, Sweden. Draft Report dated July 30, 1997.

11. **Federal Register, 40 CFR Parts 148, 261, 266, etc. Hazardous Waste Management System; Identification and Listing of Hazardous Waste; et al.; Final Rule and Proposed Rule; Thursday, August 6, 1998** (Bioavailability and Bioaccumulation, pages 42148 - 42149).

12. **On the Possibility of Accumulation of 3,4-Benzpyrene in Tissues and Organs of Cows and Calves, As Well as in Milk in Case of Presence of This Carcinogen in Fodder** (Gorelova and Cherepanova; The N. N. Petrov Research Institute of Oncology of the USSR Ministry of Public Health, Leningrad; 1970).

13. **Correlation Between The Content of Polycyclic Carcinogens in Animal Food Products and In Fodder for Farm Animals** (Gorelova, Dikun, Dmitrochenko, Krasnitskaya, Cherepanova, and Shendrikova; The N. N. Petrov Research Institute of Oncology of the USSR Ministry of Public Health, Leningrad; 1970).

14. **Guidance for Data Useability in Risk Assessment (Part A) Final** (EPA 9285.7-09A, April 1992).